
The Diversified O-RAN Showcase: Unifying Open Source Communities



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Presentation Outline

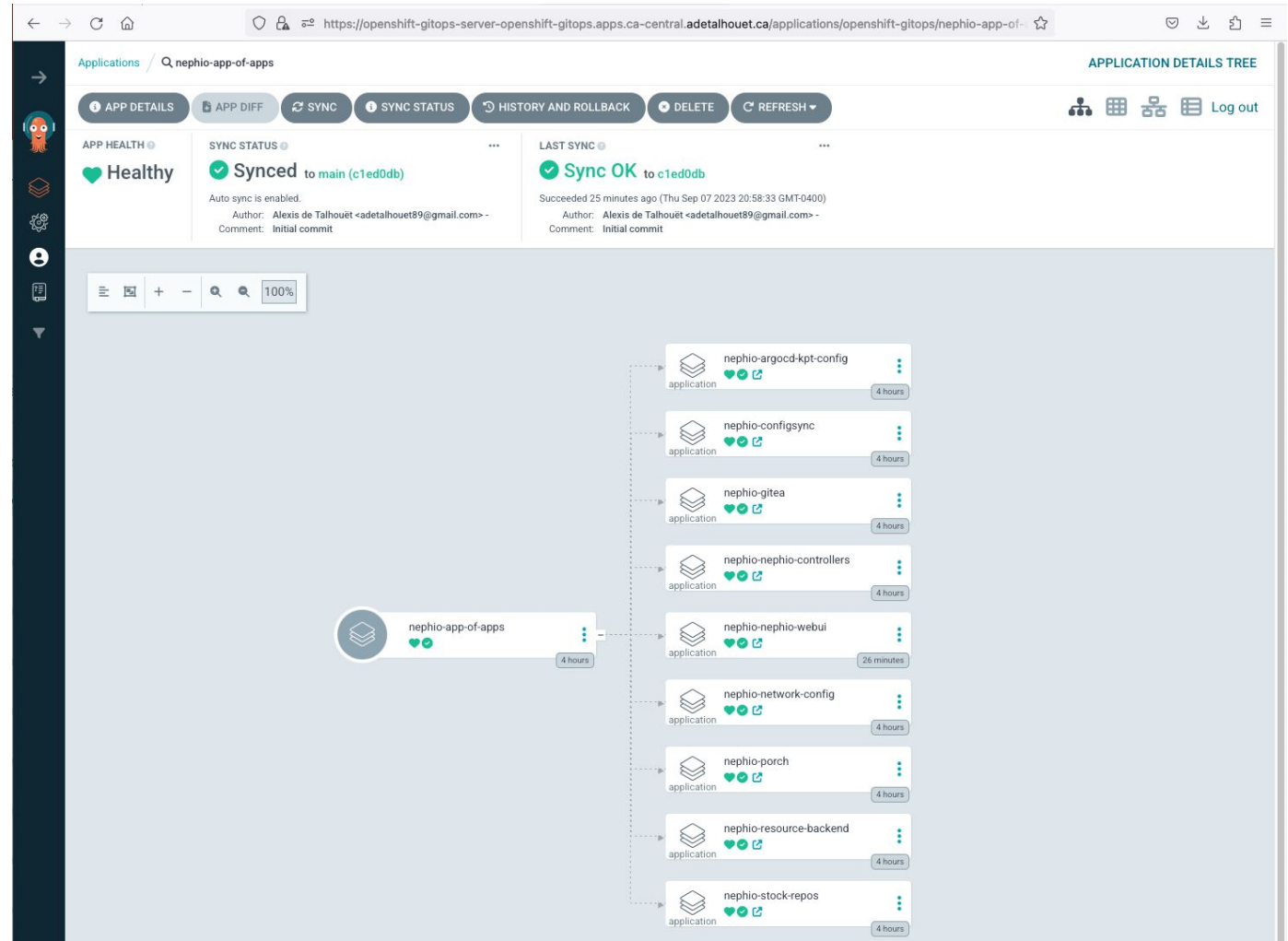
- **CaaS Platform**
 - Nephio deployment
 - Single Node Clusters
- **O-RAN Network Functions**
 - Intent based deployment
 - Operators overview
- **CaaS Configuration**
 - Demo
 - Solution Architecture



CaaS Platform

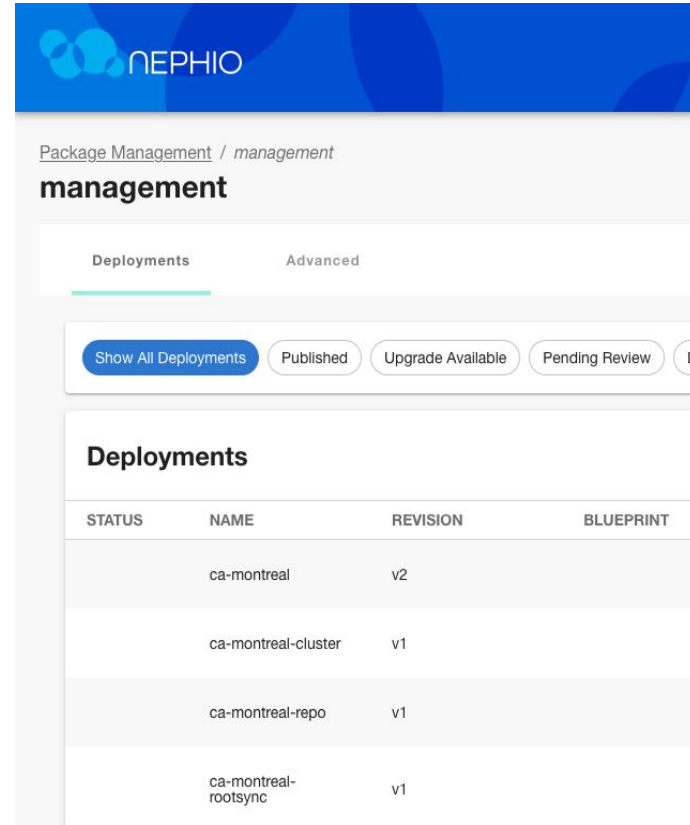
Blueprint for Nephio deployment on OpenShift

- Provide packages for all the required components to deploy Nephio R2 release
- Introduce an ArgoCD Configuration Management Plugin (CMP) to render kpt package pipeline properly
- Generate an ArgoCD Application for each individual components, and apply some OpenShift specific configuration



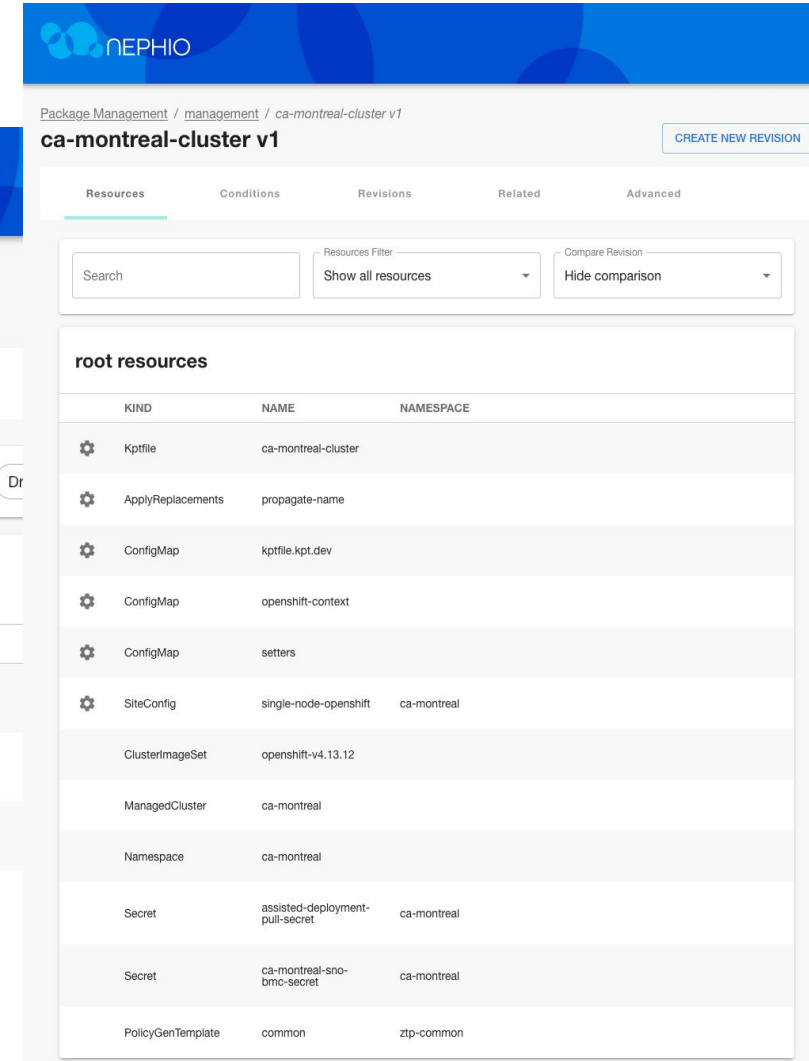
Blueprint for Single Node OpenShift deployment with Nephio

- Provide packages to create a Single Node OpenShift workload cluster
- Introduce two OpenShift-specific kpt functions
 - policy-gen-fn
 - siteconfig-gen-fn



The screenshot shows the Nephio management interface. The breadcrumb trail is "Package Management / management". The main heading is "management". There are two tabs: "Deployments" (active) and "Advanced". Below the tabs are filters: "Show All Deployments" (selected), "Published", "Upgrade Available", and "Pending Review". The "Deployments" section contains a table with the following data:

STATUS	NAME	REVISION	BLUEPRINT
	ca-montreal	v2	
	ca-montreal-cluster	v1	
	ca-montreal-repo	v1	
	ca-montreal-rootsync	v1	



The screenshot shows the Nephio management interface for the "ca-montreal-cluster v1" deployment. The breadcrumb trail is "Package Management / management / ca-montreal-cluster v1". The main heading is "ca-montreal-cluster v1". There are tabs: "Resources" (active), "Conditions", "Revisions", "Related", and "Advanced". Below the tabs are filters: "Search", "Resources Filter" (set to "Show all resources"), and "Compare Revision" (set to "Hide comparison"). The "Resources" section contains a table with the following data:

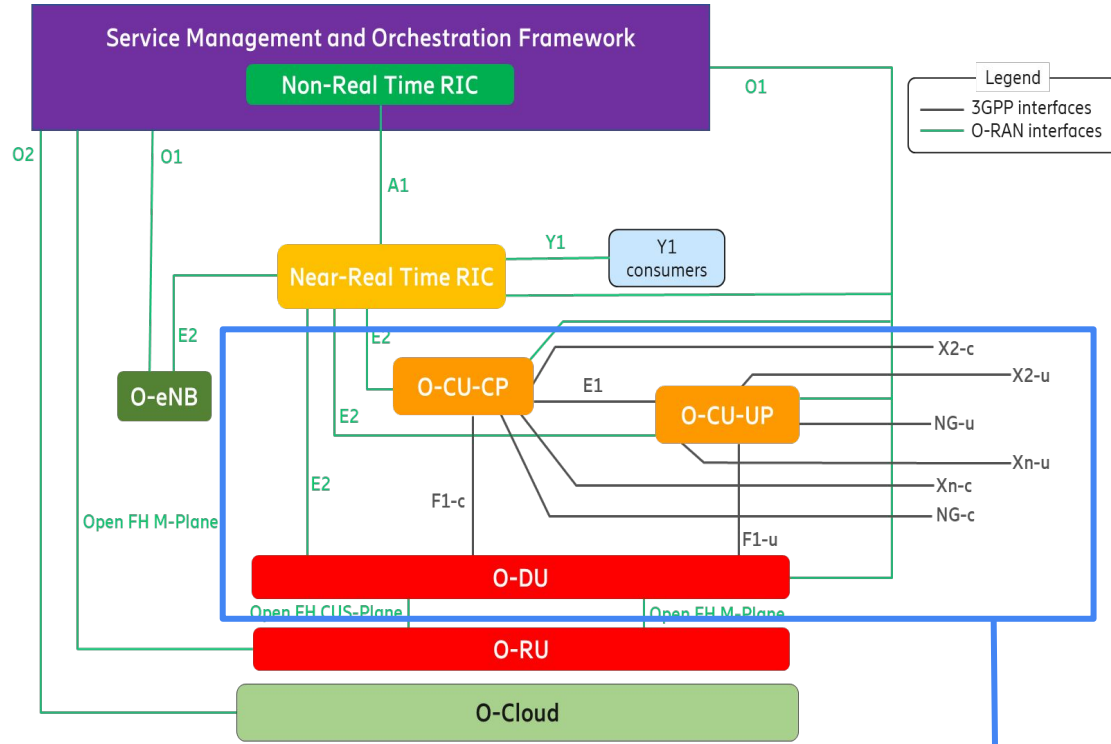
KIND	NAME	NAMESPACE
Kptfile	ca-montreal-cluster	
ApplyReplacements	propagate-name	
ConfigMap	kptfile.kpt.dev	
ConfigMap	openshift-context	
ConfigMap	setters	
SiteConfig	single-node-openshift	ca-montreal
ClusterImageSet	openshift-v4.13.12	
ManagedCluster	ca-montreal	
Namespace	ca-montreal	
Secret	assisted-deployment-pull-secret	ca-montreal
Secret	ca-montreal-sno-bmc-secret	ca-montreal
PolicyGenTemplate	common	ztp-common



O-RAN Network Functions

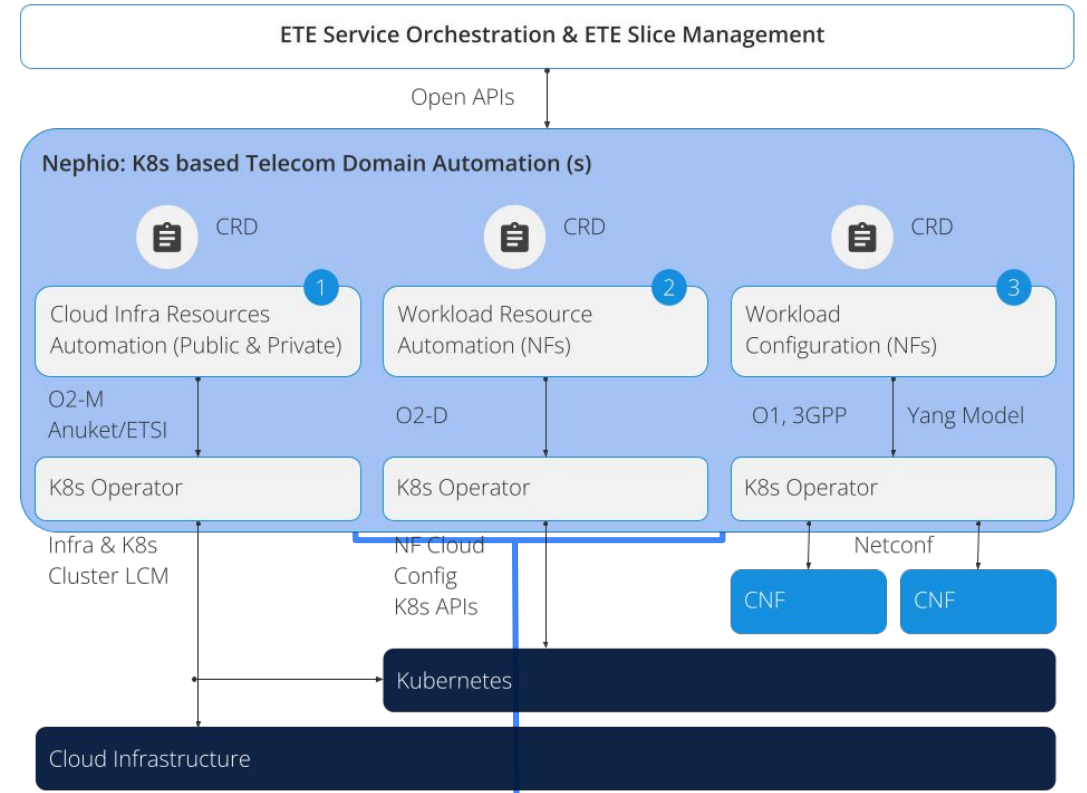


Architecture Mapping



Source: O-RAN Alliance (O-RAN.WG1.OAD-R003-v10.00)

CNFs Provided by OpenAirInterface



Source: Nephio Website

Simplified Operators for deploying OAI NFs (not O-RAN 02)

Intent Based Deployment

Intent: Network function requirements

Realization: Nephio KRM functions

Example KRM functions pipeline

```
ne:
mutators:
- image:
/kpt-fn/apply-replacements:v0.1.1
  configPath: apply-replacements-owner.yaml
- image:
/kpt-fn/apply-replacements:v0.1.1
  configPath:
replacements-namespace.yaml
- image: gcr.io/kpt-fn/set-namespace:v0.4.1
  configPath: cm-namespace.yaml
- image: docker.io/nephio/nf-deploy-fn:v2.0.0
- image: docker.io/nephio/interface-fn:v2.0.0
- image: docker.io/nephio/nad-fn:v2.0.0
- image: docker.io/nephio/interface-fn:v2.0.0
- image: docker.io/nephio/nf-deploy-fn:v2.0.0
```

OAI DU Deployment NF Deployment (CR)

```
apiVersion:
workload.nephio.org/v1alpha1
kind: NFDeployment
metadata:
  name: du-example
  namespace: example
spec:
  provider: du.openairinterface.org
parametersRefs:
- name: oai-du-config
  apiVersion:
workload.nephio.org/v1alpha1
  kind: NFConfig
```

OAI DU NF Config (CR) [Meta CR]

```
apiVersion: workload.nephio.org/v1alpha1
kind: NFConfig
metadata:
  name: oai-du-config
  namespace: example
spec:
  configRefs:
  - apiVersion:
workload.nephio.org/v1alpha1
  kind: RANConfig
  metadata:
    name: ranconfig
  spec:
    gNBID: 12
    rfSimulated: false
    nrCellId: 1 ...
```

KRM functions are generic and not RAN or Core specific

OpenAirInterface K8s Operators

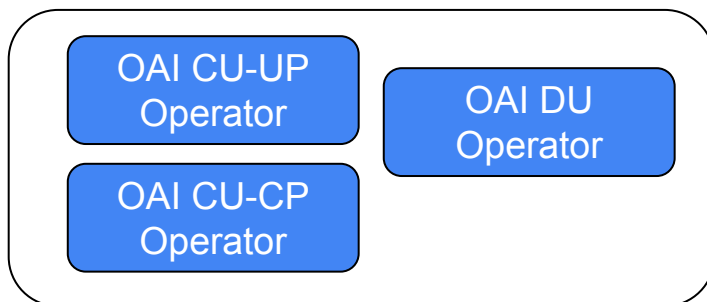
Design Considerations

- One Operator per NF
- Operators supports
 - OAI specific CRs
 - Nephio CRs
 - NFDeployment, NFConfig

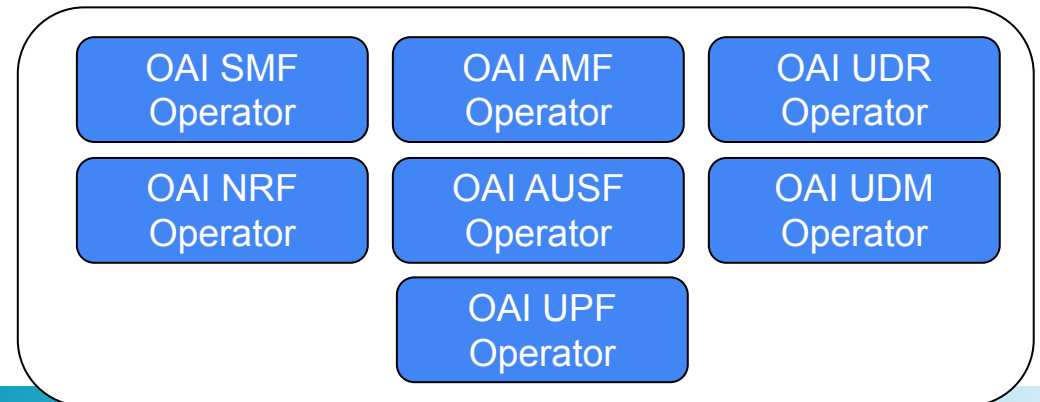
Interesting facts

- The RAN operator developed in Nephio R2 using Helm SDK was designed to orchestrate only Simulated DU
- RAN and Core network function operators developed in python using the KOPF.

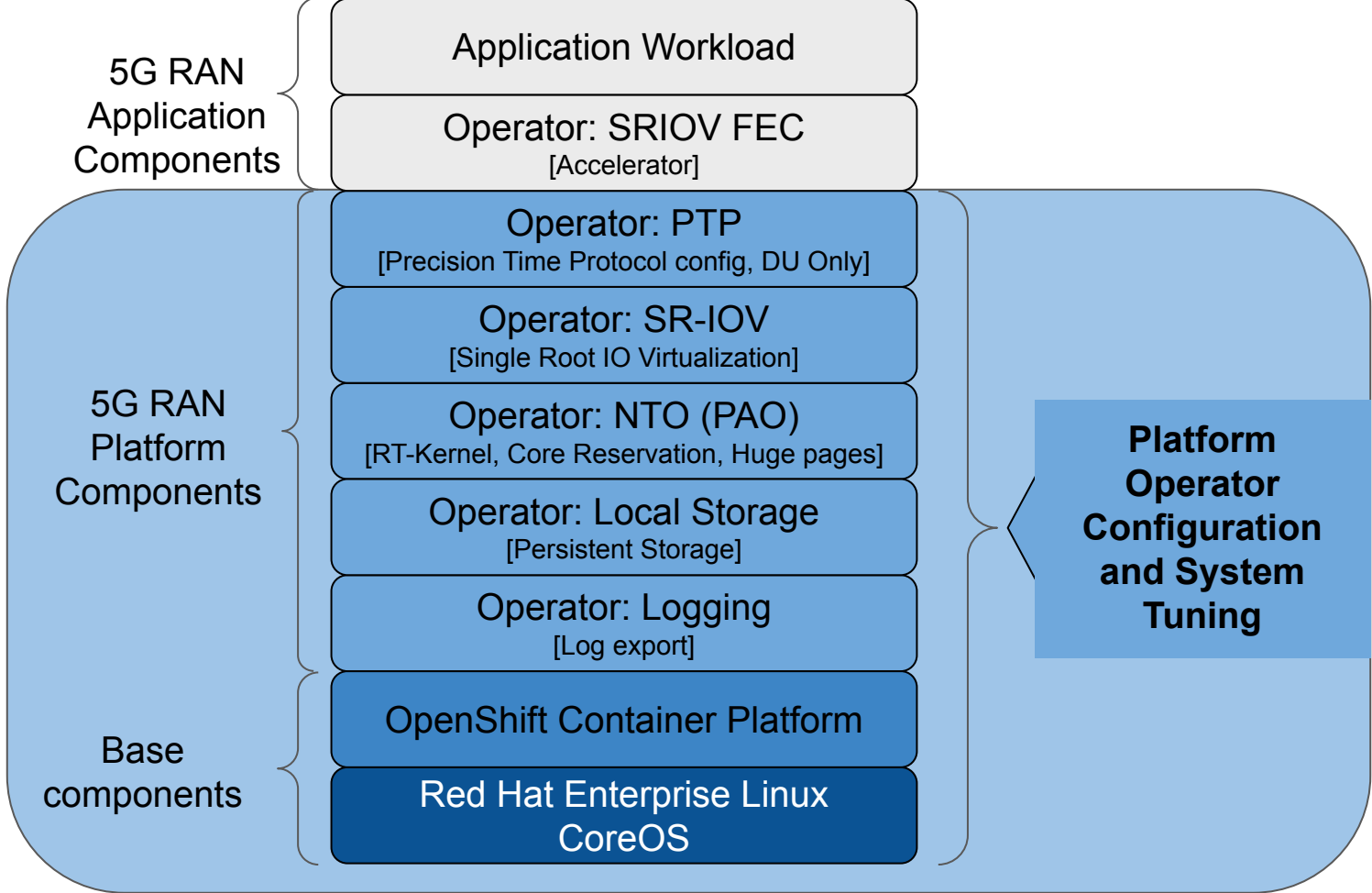
OAI RAN Network Function Operators



OAI Core Network Function Operators



CaaS Configuration for DU workload



DU Profile

Requirements for OAI DU

Tested Hardware

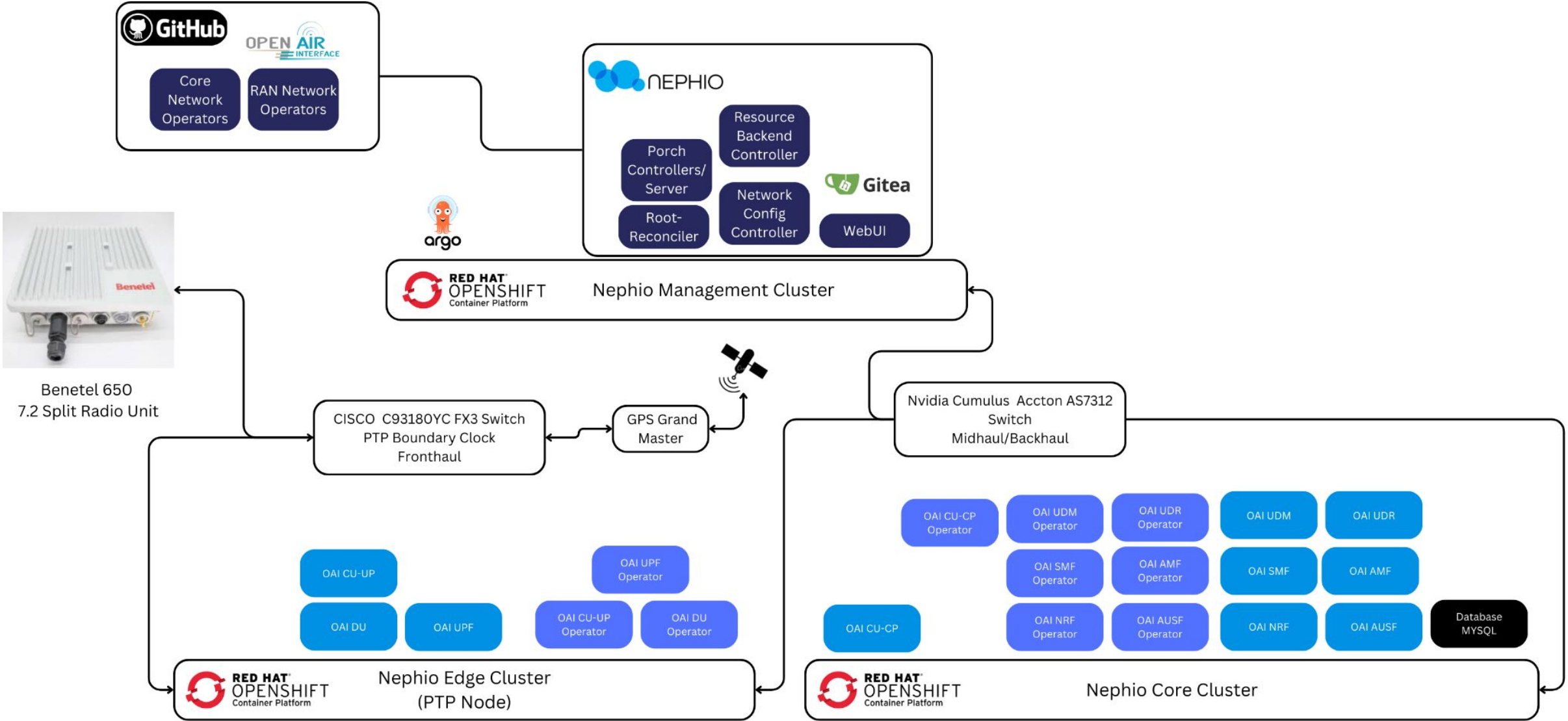
- Minimum Intel 3rd generation gold servers or AMD 4th generation (Genova)
- Intel XX710, X710 and E-810 are the only NICs we have tested



Recommended resources

- 8 CPU,
- 4G RAM
- 10Gi Hugepages of size 1Gi

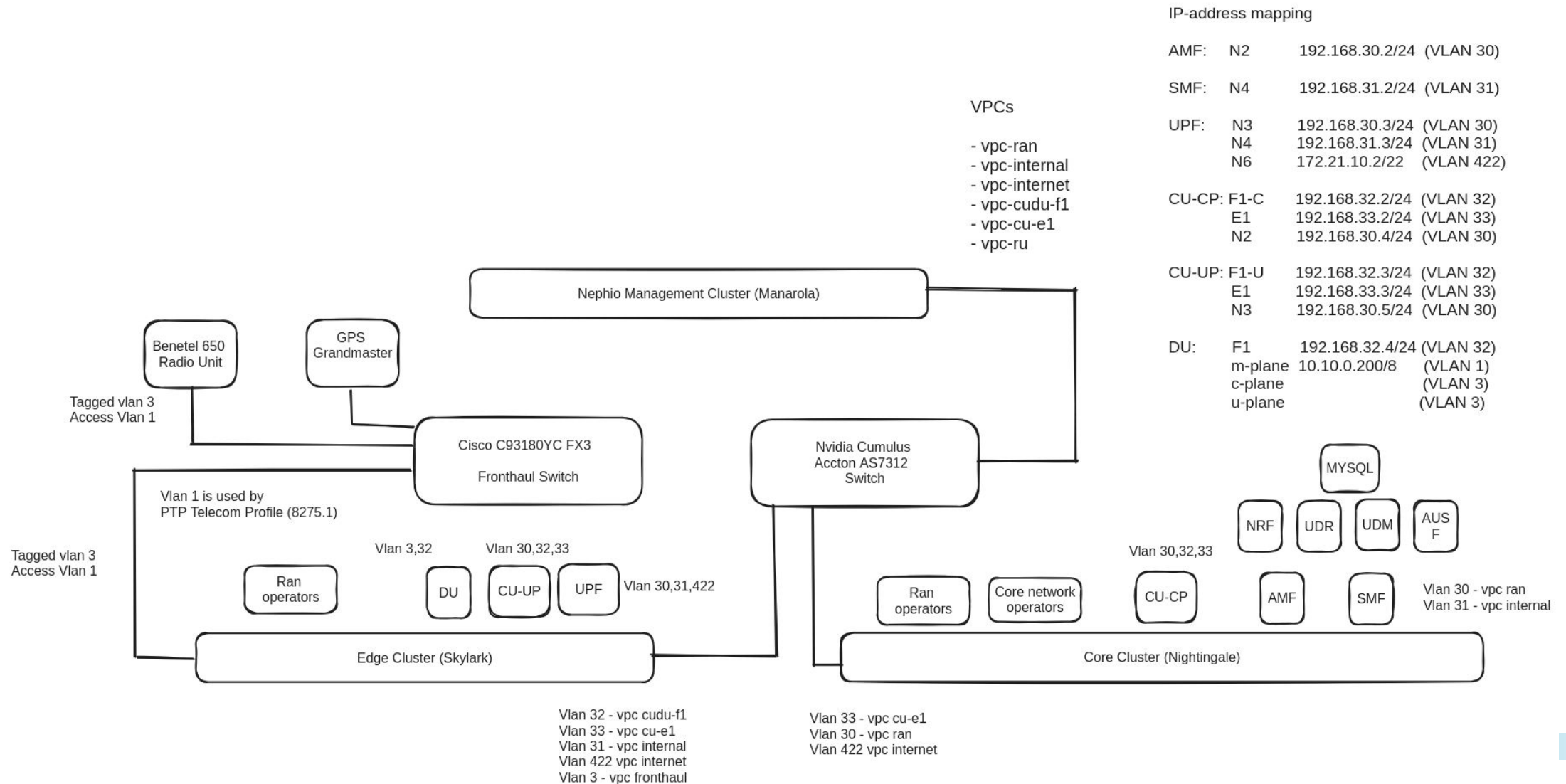
Demo Architecture



Demo Video



Demo Architecture



The Diversified O-RAN Showcase: Unifying Open Source Communities



- Orchestration of OAI O-RAN NFs and OAI Core NFs via Nephio on single node openshift cluster
- Benetel 650 (Outdoor O-RU)
- LLS-C3 architecture for O-RU and O-DU
- Nephio components deployed and managed by ArgoCD on Openshift
- Single Node Openshift clusters created and managed by Nephio
- OAI RAN and Core NF operators are written using Kubernetes Operators Framework (KOPF)
- Part 2: developer environment with T2

